

CENTRAL REGION INTEGRATED SCIENCE PARTNERSHIP PROPOSAL

Project Title: Developing integrated modeling methods for assessing the effects of coalbed methane production on emergent wetlands in southeastern Montana.

Principal Investigators: Vito Nuccio, GD; John Kilpatrick, WRD; Tim O'Neill, NMD; Richard Sojda, BRD.

Partners/Collaborators and Affiliations: Bureau of Land Management; Bureau of Indian Affairs; US Fish and Wildlife Service; USDA Natural Resources Conservation Service; MT Department of Environmental Quality; MT Fish, Wildlife, and Parks; MT Wetlands Legacy; Cornell University; Montana State University

Total Funding Requested: 50K

Proposal Submission Date: 11 February 2002

Problem: During the next ten years, thousands of coalbed methane (CBM) wells in Montana and Wyoming may withdraw millions of gallons of water from target coals and discharge it to infiltration ponds, streams, or injection wells. The impacts of this are unknown. Maintaining wetland processes in these human-modified systems requires the understanding of dynamic, historic wetland ecological processes and management strategies. This involves not only ecological questions about wetland successional stages, but geological, temporal, and spatial questions, as well. Critically, these relationships must be viewed from a hydrologic landscape unit perspective and related to patterns of use by waterfowl and other wetland birds. Little work has been done to identify wetlands in the areas that are most vulnerable to potential impacts from CBM development.

Objective: Working with stakeholders, we will examine wetlands that typify key wetland processes and patterns of use by wildlife. We will develop a conceptual model of how these wetlands function hydrologically, the importance of the wetland area to waterfowl and waterbirds, and the extent to which the wetland is likely to be impacted by CBM development. Finally, we will publish a conceptual model of wetland function, providing stakeholders with a plan for further study. Results of this project will allow CBM development to be managed in a way that eliminates or reduces impacts to wetlands.

Scope: Our geographic focus will be on emergent wetlands in the Tongue and Powder River watersheds of southeastern Montana. Our potential partners have indicated that slightly higher natural resource values may be present in the former, but part of this project is to identify what key wetlands exist from a wetland bird perspective. Because so little is known about both emergent wetlands and CBM in this, and the broader region, the work we propose will have ecological value throughout the Northern Rockies and adjacent Great Plains.

Approach:

- BRD and WRD will review the National Wetland Inventory maps and videotaped imagery of 655 miles of stream completed by the Natural Resources Conservation Service, concentrating on the floodplains of the mainstem rivers. We will select what appear to be the most important emergent wetlands, especially from a waterfowl and other wetland bird perspective.
- The interdisciplinary team will assemble in the field to gain first-hand observational experience with wetlands in the region and to discuss field experiments that might be conducted to better understand the ecology of these wetlands in relation to hydrologic landscape units, wetland successional stage, water bird values, and CBM production water. At the end of the field visit, the team will select elements of a conceptual model that will link the necessary interdisciplinary features. We will solicit the assistance of Cornell University Wetland Scientist, Barbara Bedford, for expertise in wetland hydrologic landscape perspectives.
- GD will detail the factors that are critical to CBM occurrence and production. These include such parameters as geologic setting, distribution, depth and thickness of coalbeds, gas content of coal, gas quality, and quality and quantity of the water that will likely be produced. GD will suggest scenarios of the interaction of produced water into the wetlands, but also into target reservoirs, if the produced water is required to be reinjected. GD and NMD will work together to hypothesize what the interaction between surficial mineralogy and water chemistry will mean to potential sodium hazards (SAR). NMD will suggest the usefulness of hyperspectral data in identifying surficial mineralogy of the study area.

- GD and WRD will describe geomorphological processes influencing Holocene development of study wetlands. We suspect that fluvial processes, incision history, and artificial control of water will be major influences on wetland development and succession.
- CBM development in the study area(s) will almost certainly not be the only process to consider in wetlands management. NMD will study potential data sources for use in determining the landscape history and how the study area(s) have changed over time. NRCS will be consulted to determine an historical baseline for the analysis. This work will determine the requirements for 1) conducting a temporal land use/land cover analysis from the historic baseline to the present, and 2) producing a landscape change model to acquire a better understanding of what natural and human-induced processes contributed to landscape alteration over time.
- Base GIS data layers will be assembled at NRMSC under supervision of NMD. This will include ensuring a common base for all project spatial data, obtaining and integrating datasets necessary for base-layer construction, and maintaining a project geospatial database. A working map of the study areas will be developed and base GIS layers will be made available via the NBII Northern Rockies Information Node.
- We will contract with Montana State University Professor, John Paxton, to assess artificial intelligence methodologies for our interdisciplinary model. In collaboration with him, BRD will propose a modeling methodology. The team will collaboratively consider individual elements, propose relationships to integrate them, and propose how to represent them conceptually.
- A journal article will be prepared for publication delineating our conceptual model and potential ways to build and validate it.
- An additional plan, based on the conceptual model, for additional interdisciplinary work will be prepared and presented to the USGS and potential collaborators.

Benefits: This project will provide stakeholders with information about wetlands that might be affected by CBM development in southeastern Montana. The integrated science approach to this study will identify for them, the kind of work that needs to be done to fully understand potential impacts of CBM development on area wetlands and the waterfowl and water birds that use them. Importantly, no such work has been attempted to date.

Outcome/Products:

- Map and base coverages of study wetlands/areas.
- Integrated science conceptual model of how area wetlands function hydrologically, their successional cycles, and their importance to waterfowl and other water birds.
- Journal article describing the conceptual model.
- Detailed plan for a model of wetland function along with information that directly supports managing CBM development on Federal land (to be presented to USGS management and potential stakeholders).
- *Although not directly part of this proposal, if funded for a second year, we would be able to move from the conceptual modeling phase to actual model development and field study.*

Budget: The Northern Rocky Mountain Science Center will administer the project, but will not assess indirect costs on those funds passing through to the other Cost Centers.

CATEGORY	Amount needed by each cost center [in \$K]				
	Geologic Division	WRD-Montana District Office	Northern Rocky Mountain Science Ctr. ^{1.}	Rocky Mountain Mapping Ctr.	TOTAL
Salary		5.9	5.5		
Travel	4.0	1.0	5.0	5.5	
Map/Remote Sensing Data			1.0	1.0	
University Contracts			11.0		
Indirect Costs	2.0	3.1	2.5	2.5	
Total	6.0	10.0	25.0	9.0	50.0

1. includes: travel for NRMSC GD staff; 15 weeks NRMSC GIS technician supervised by NMD staff

Time Line:

DATE	Activity
Apr 2002	distribute funds to each cost center
	hold 2 conference calls among science team
	finalize arrangements with Cornell University and Montana State University
	schedule field work
May 2002	review NRCS video
	begin assembling base GIS layers
	select preliminary field sites
	BRD/WRD visit preliminary field sites
Jun 2002	base GIS layers assembled, first iteration
July 2002	field work
Aug 2002	workshop to develop conceptual model and outline journal article
Sep 2002	first draft of journal article
Oct 2002	submit journal article

